Hydrometeorological Products for Hazard Mitigation

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Who/What is HPC?

- Part of NCEP & located a suburb of Washington, DC
- Resource to NWS field forecasters, partners & customers
- Produces a wide variety of products that can be used to mitigate
  - Loss of life
  - Injuries
  - Loss of property

Partners & Customers

- NWS Field offices – WFOs, RFCs & CWSUs
- Other NCEP centers – OPC, TPC, AWC, SPC, EMC, NCO & CPC
- Federal Agencies - DHS/FEMA, COE, FAA, NTSB, DoD, EPA, White House
- State Agencies – EMA, water resources, flood management & DOT
- Media – TV, Radio, Internet, newspapers, wire services (AP/UPI)
- Private Sector – data vendors, forecast services, utilities, forensics, retailers, researchers
- Aviation – General aviation, AWC
- Academia – Universities & colleges
- International – MET services, media, travelers
- General Public – Analysis/forecast products

Past HPC Hazard Mitigation Services

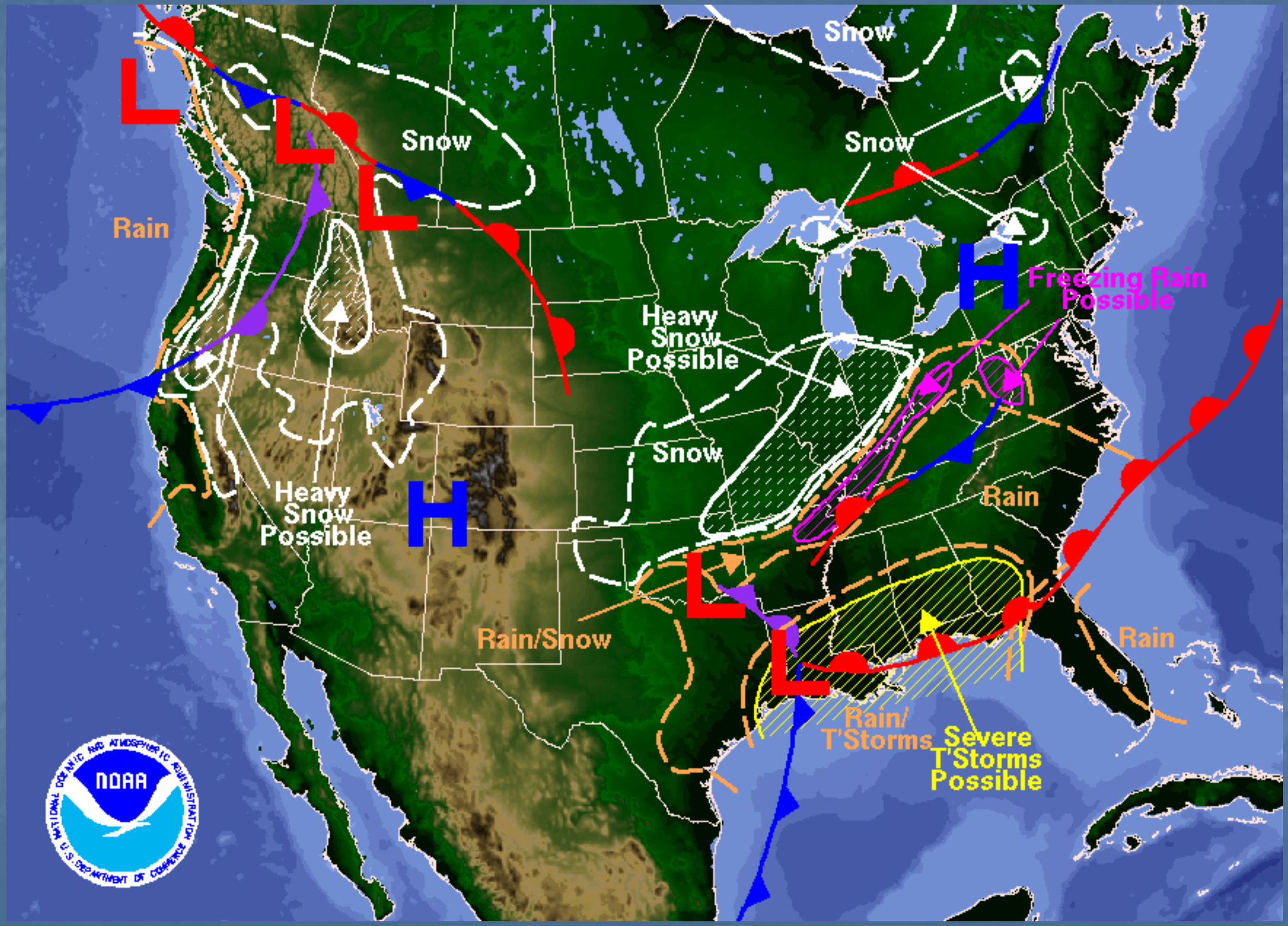
- Special forecasts for mid-West floods (USACE & FEMA, 1993)
- Presidential Inauguration support (1997, 2001)
- Forecasts for Mexican & Guatemalan fires (USAID, 1998)
- Y2K Information Coordination Center (White House, 1999-2000)
- Recovery from terrorist attacks (White House, 2001)
- Capitol Hill briefings on weather events/activities (Isidore, 2002)
- Weather Support to Hurricane Mitch mitigation (USAID, 1998)
- Backup to NHC's hurricane program
- Hurricane Liaison Team briefings
- Precipitation statements in TPC Public Advisories
- Public Advisories for formerly named tropical cyclones after landfall
- Media interviews & press conferences
- Winter storm & Heavy rainfall event summaries

Current Products HPC Issues

- **QPF**
  - 6 hourly D1 - D3
  - 48 hr QPF D4-D5
  - D1 – D5 QPF
  - QPFPFD
- **Flood Products**
  - Excessive Rainfall D1, D2 & D3
  - QPFERD
  - River Flood Outlook
- **Winter Weather** (9/15 - 5/15)
  - Snow/ZR Probability
  - Snow/ZR accumulation D1 - D3
  - QPFHSD
  - Winter Storm Summaries
  - Low Track Forecast
- 3 hourly Surface Analyses
- **Short Range** (D 1-2.5)
  - Fronts/Pressures
  - Instantaneous Pcpn & Pcpn Type
- **Medium Range** (D3-7)
  - 24 hr Front/Pressures
  - Max/Min/12 hr PoPs
  - PREEPD and PMDEPD
  - Hawaii Narrative
- Model Diagnostics
  - 500mb prog for West/E Pac
  - PMDHMD
  - PMDEPD
  - NDFD Chat Coordination
- Tropical Weather (6/1 – 11/30)
  - Backup/guidance for TPC
  - Public Advisories for inland tropical systems
  - South Amer. & Caribbean text products
- Daily Weather Map
- Air Quality Narrative (summer)
- **Probabilistic Precipitation Forecasts (PQPF)**

Best used for Mitigation Services

National Forecast Chart



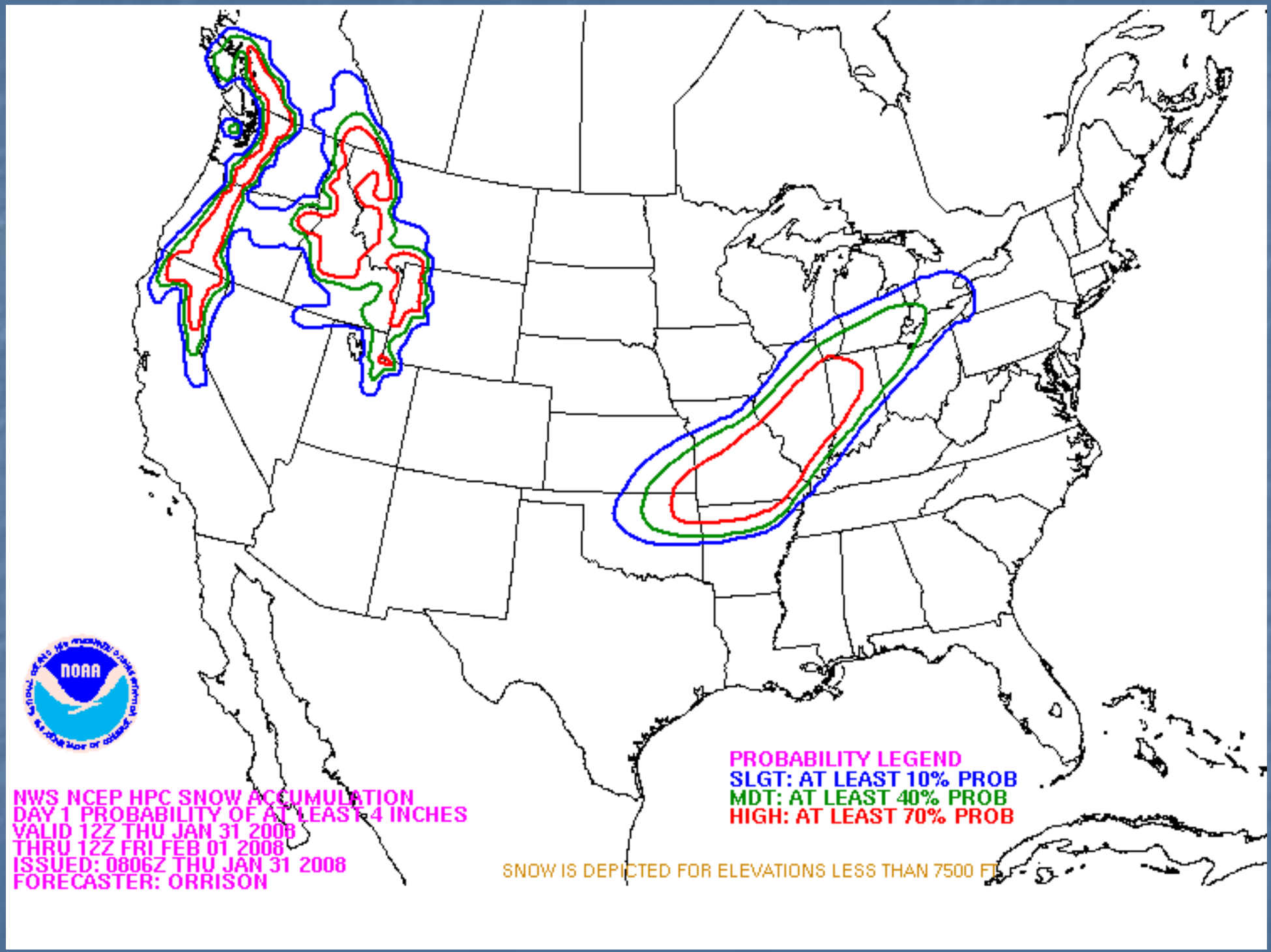
Winter Weather

- Snow and ice accumulations
  - Days 1, 2 & 3
  - Probabilistic Accumulations
    - Low, Mod & High Risk
    - 4”, 8” & 12” snow
    - 0.25” ice
- Impact Graphics
  - Based on SREF members
    - Eta, WRF & RSM
- Issued twice daily
- Longer lead-time allows for better preparation and placement of resources to minimize impacts to citizens

www.hpc.ncep.noaa.gov/wwd/winter_wx.shtml

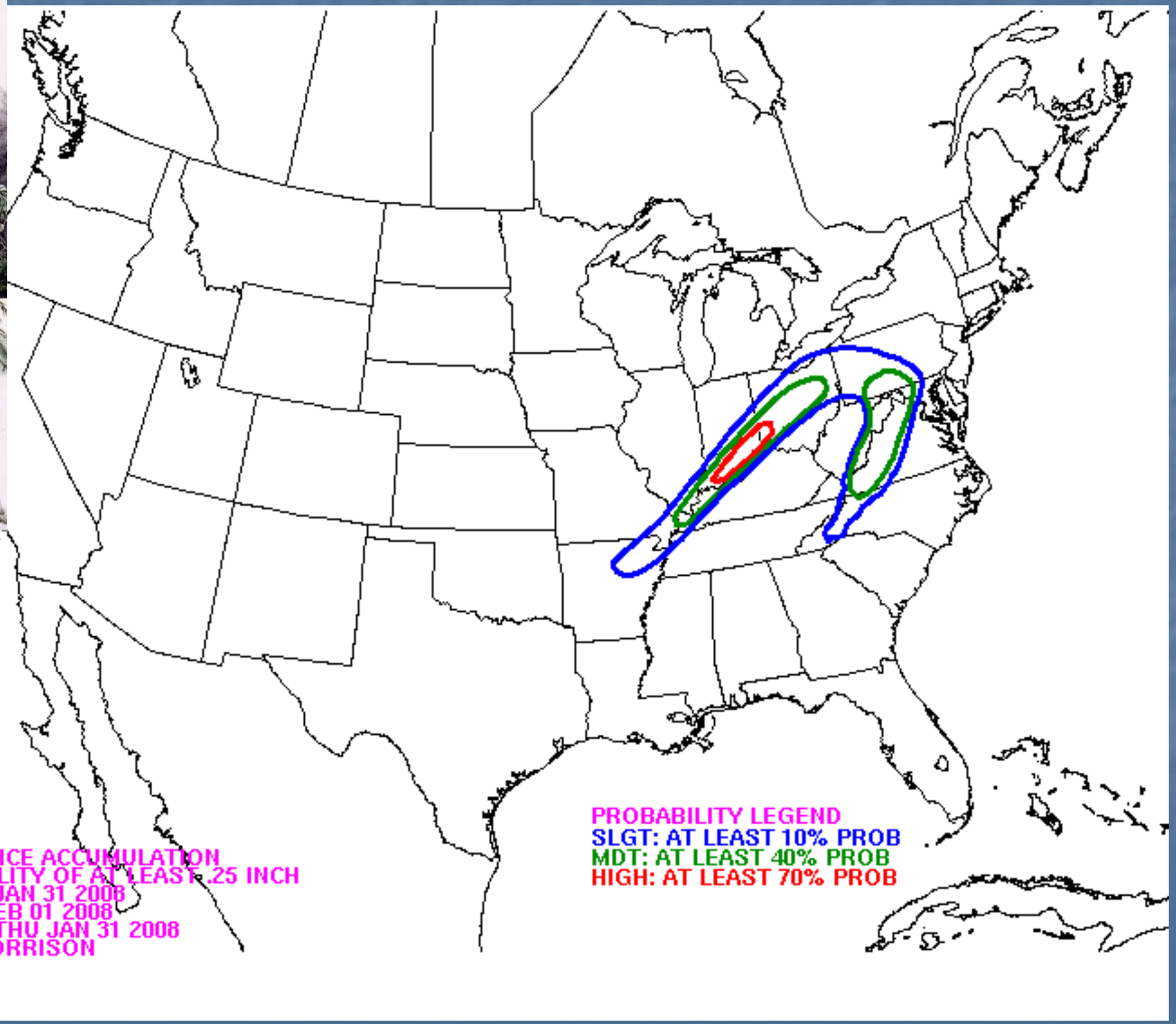
Winter Weather

Probabilistic Snow accumulations



Winter Weather

Probabilistic Ice accumulations

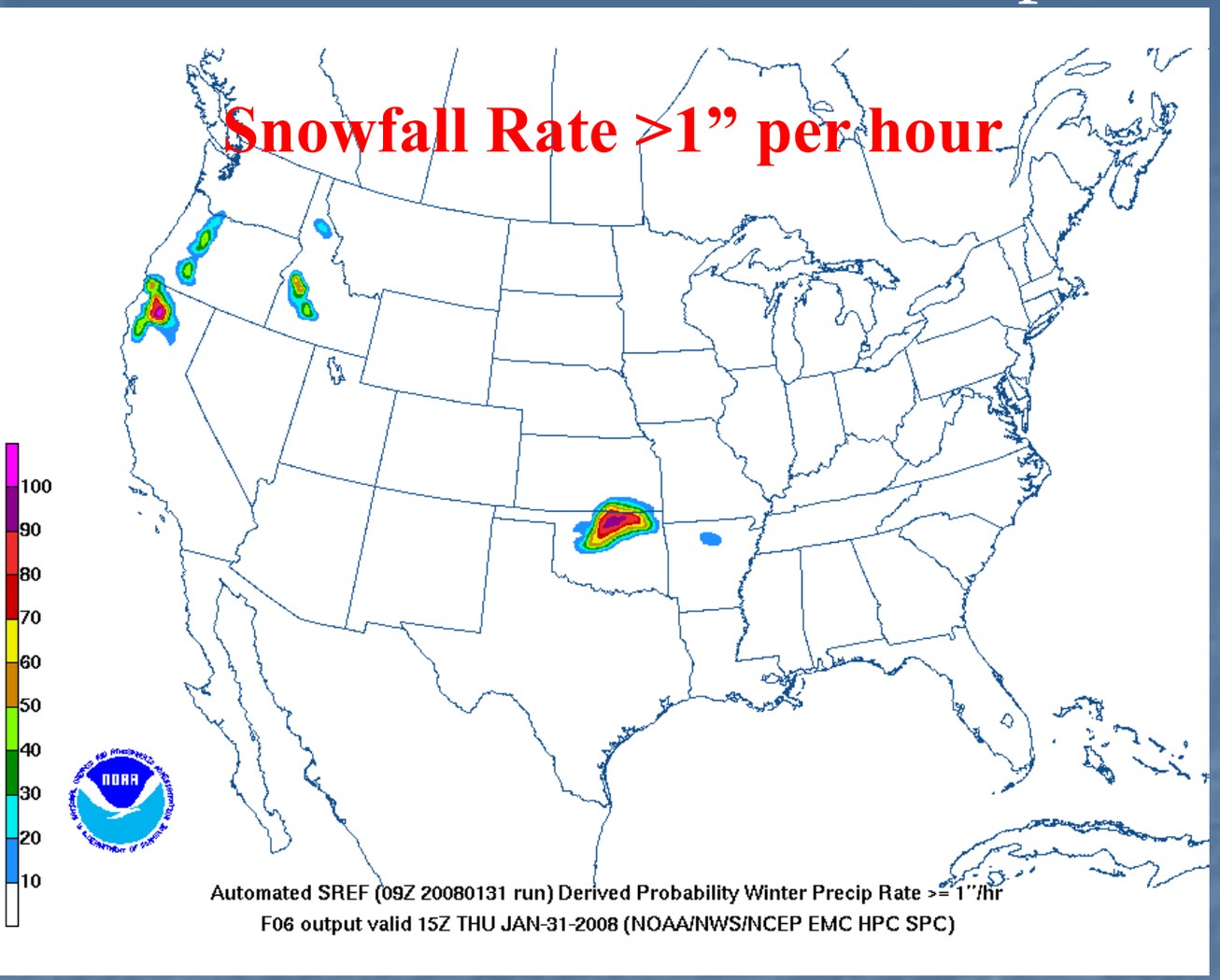


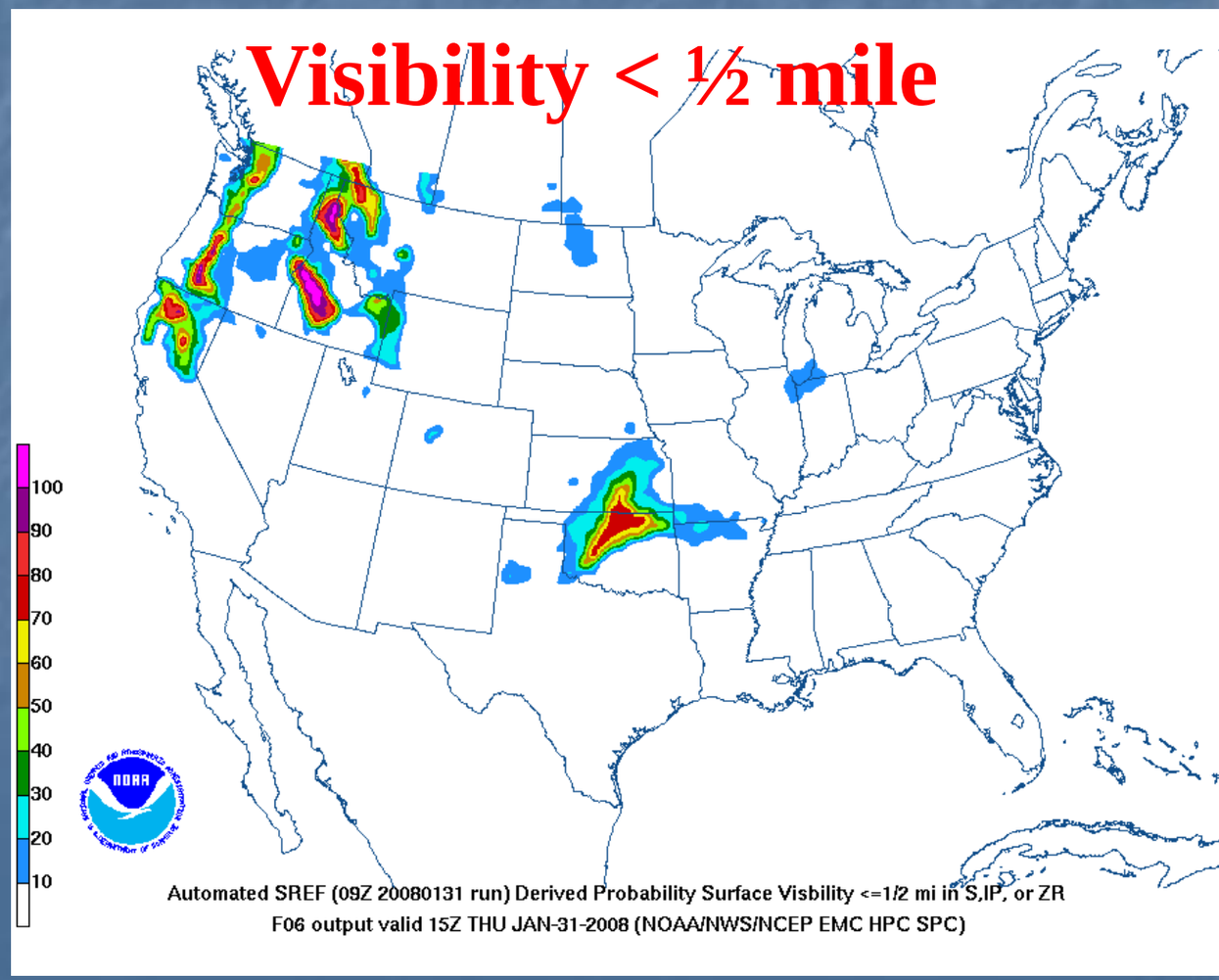
Impact Graphics

- Surface visibility
  - Eighth, quarter & half mile
- Snowfall accumulation rate
  - 1”, 2” & 3” per hour
- Duration
  - 12, 24 & 48 hours
- Probability of accumulation on roads
- Probability of freezing rain >0.01”
- Probability of Blizzard Conditions
- Exceedance of NWS WSW Criteria
  - Snow and Freezing Rain
- Mean event total accumulations
  - Snow & Sleet
  - Freezing Rain

http://www.hpc.ncep.noaa.gov/wwd/impactgraphics/

Impact Graphics





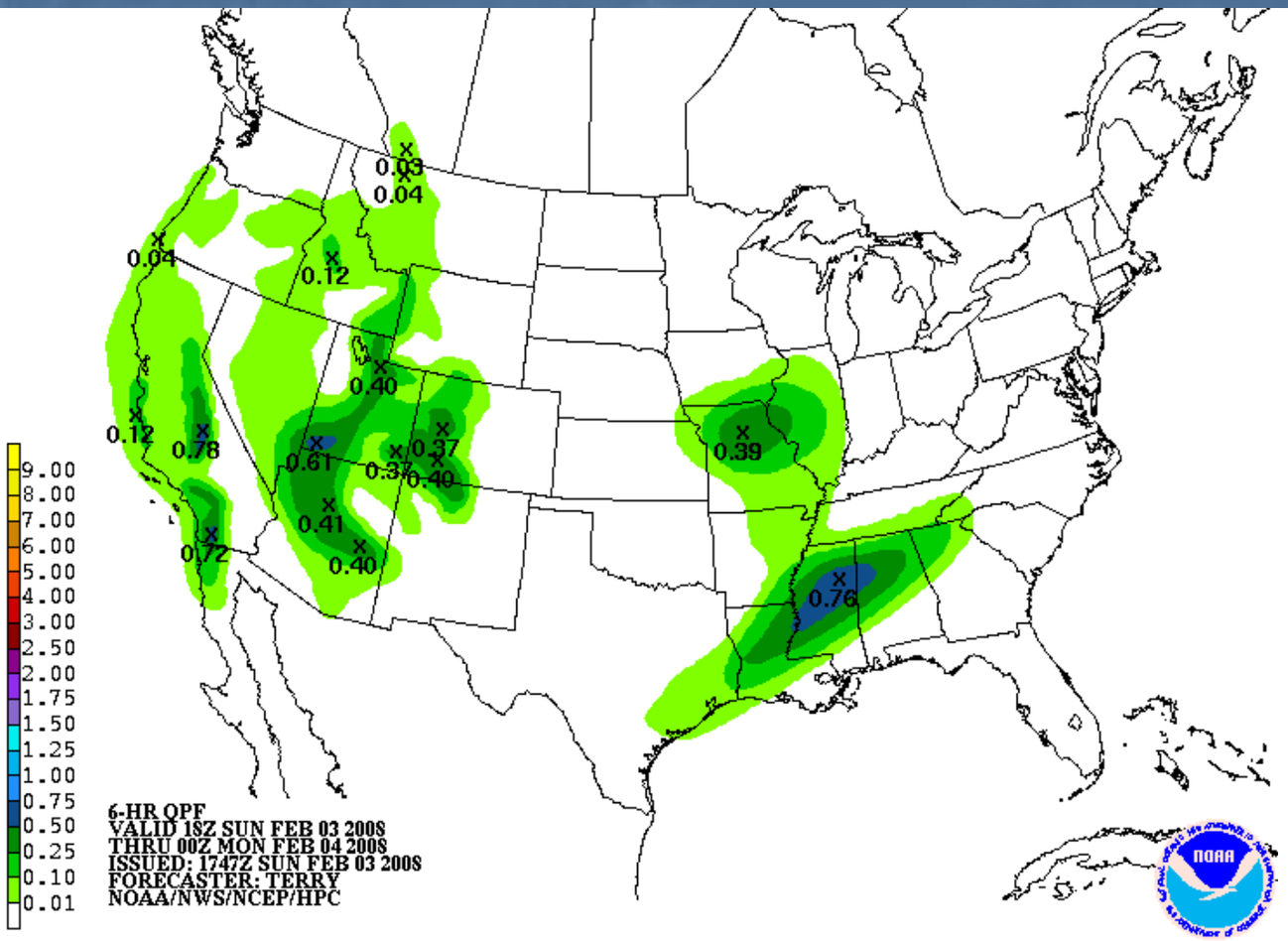
Quantitative Precipitation Forecasts

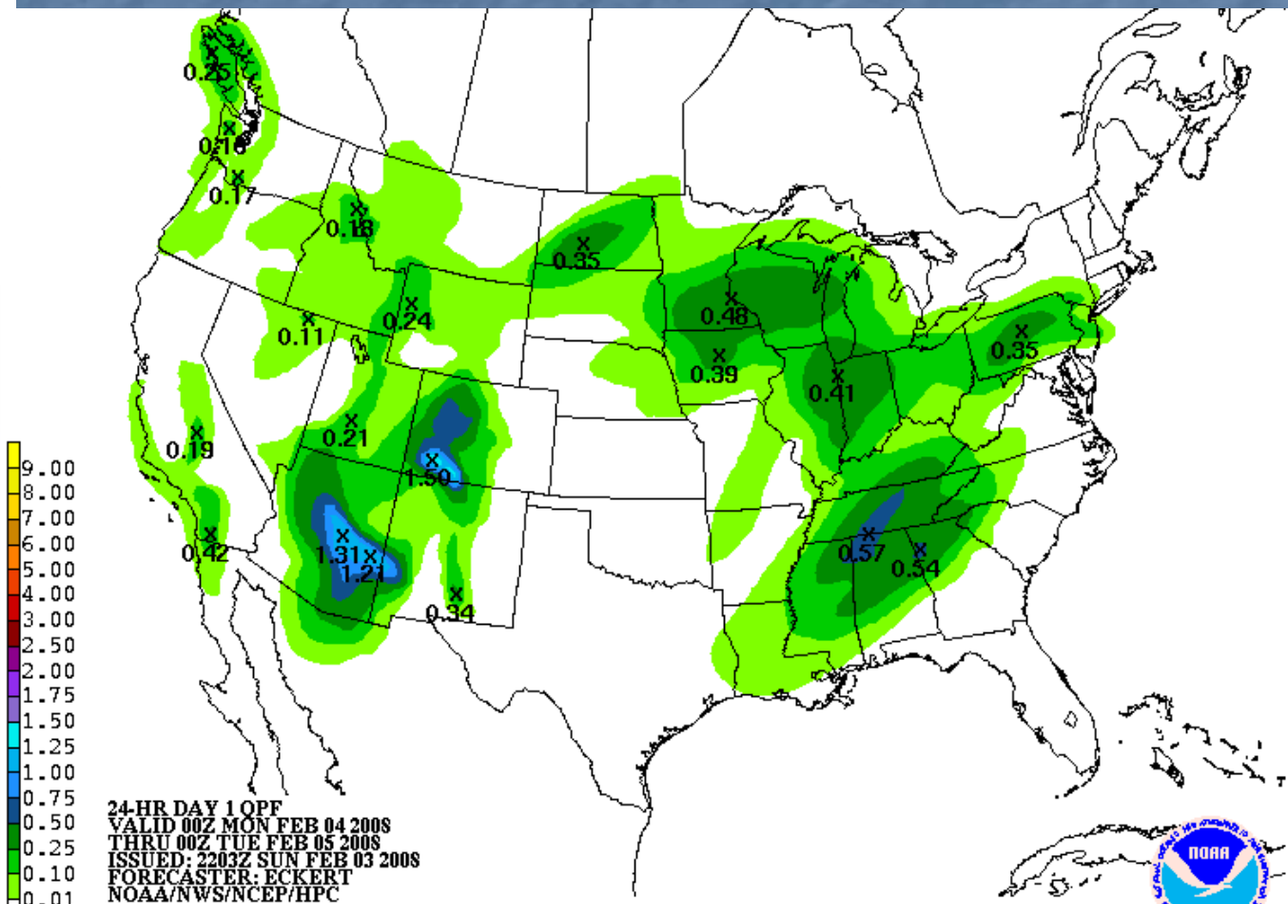
- Six hour QPF through Day 3
  - Day 1 & 2 – 06z, 10z, 18z & 22z
  - Day 3 – 10z & 22z
- 24 hour QPF through Day 3
  - Day 1 & 2 – 06z, 10z, 18z & 22z
  - Day 3 – 10z & 22z
- 48 hour QPF for Days 4-5
- 120 hour QPF for Days 1-5
  - 12z & 00z
- QPF = Fuel for Hydrologic Models

http://www.hpc.ncep.noaa.gov/qpf/qpf2.shtml

Quantitative Precipitation Forecasts

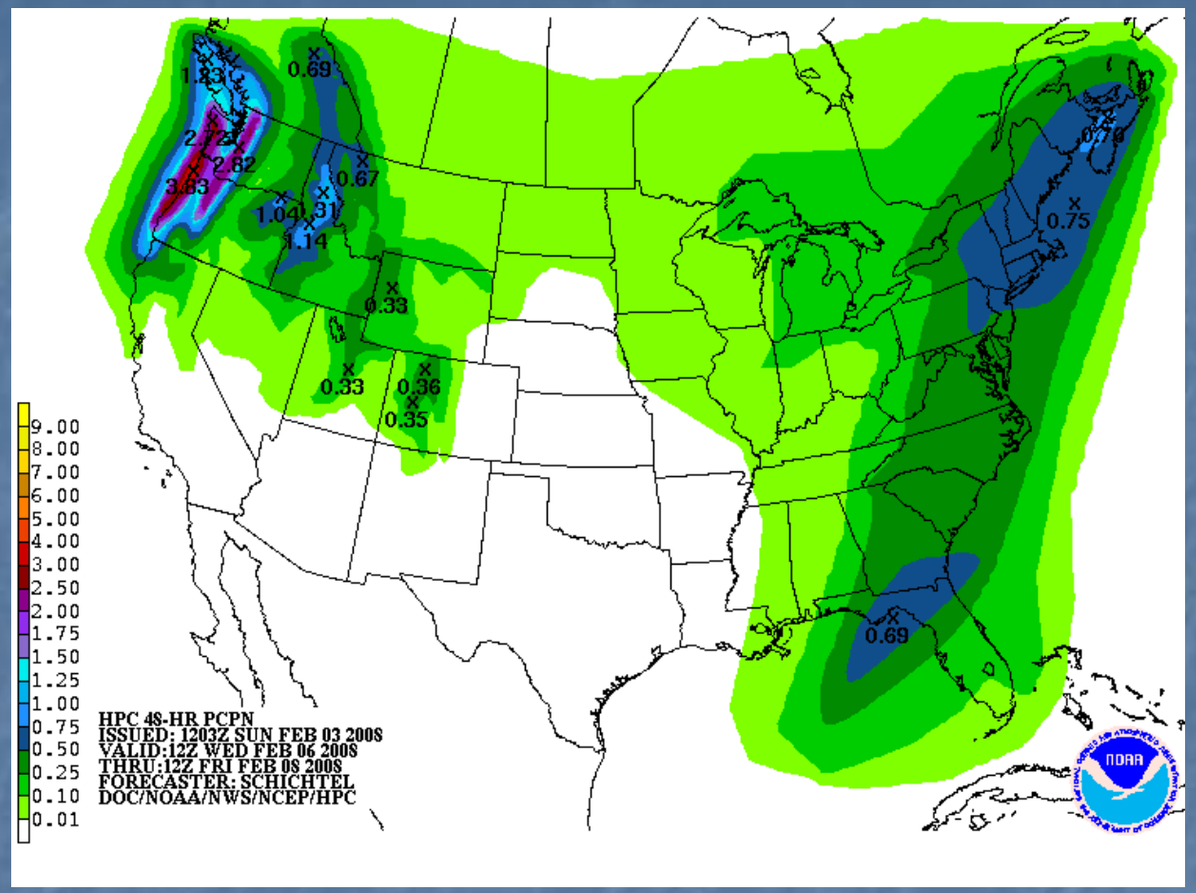
(6 and 24 hour forecasts)





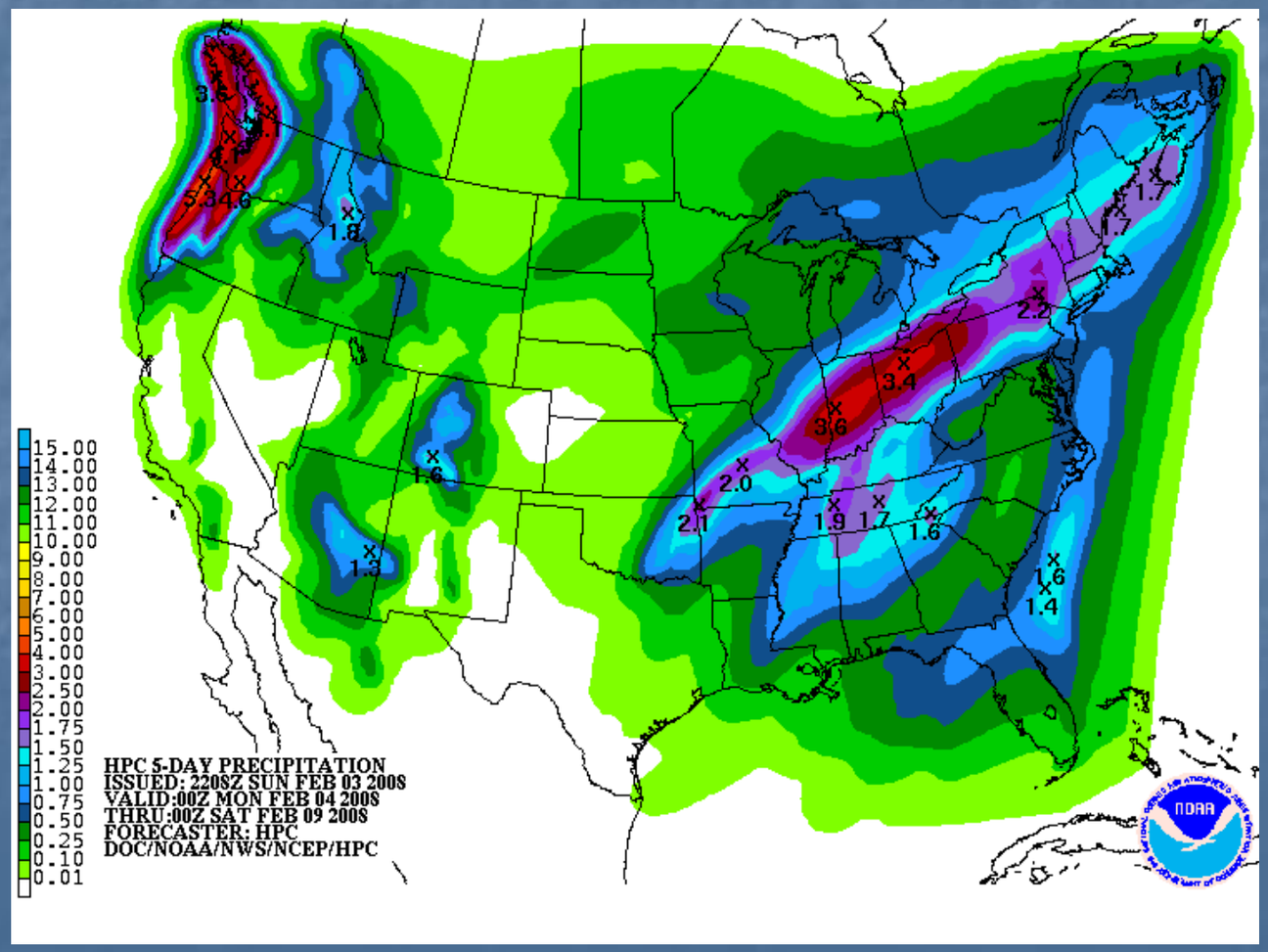
Quantitative Precipitation Forecasts

Day 4-5 & Day 1-5 forecasts



Mainly used for longer term planning

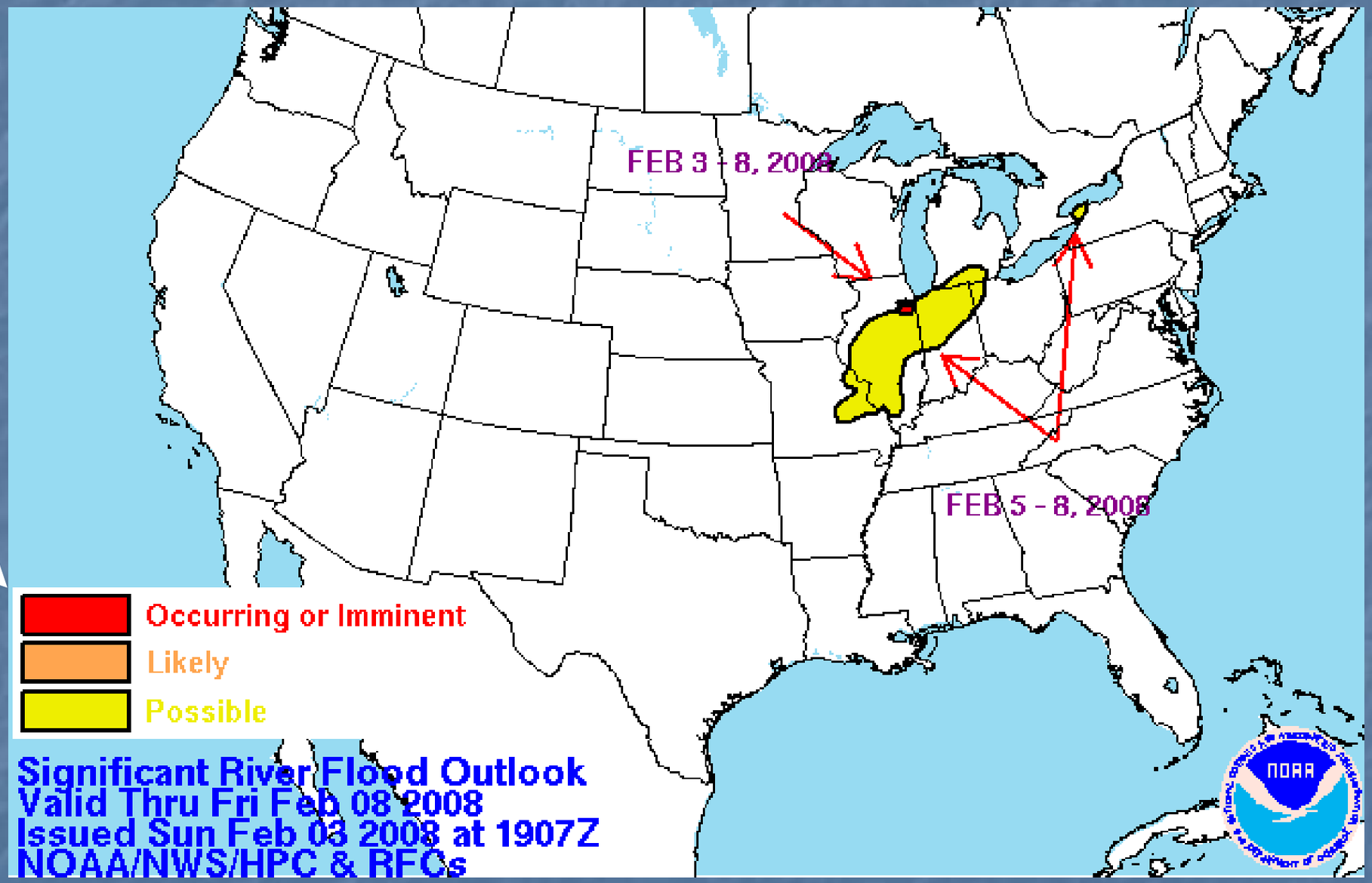
Give users an idea of where to begin to focus mitigation services before an event



Significant River Flood Outlook

RFCs produce river forecasts and HPC compiles into a National Chart

Threat Levels

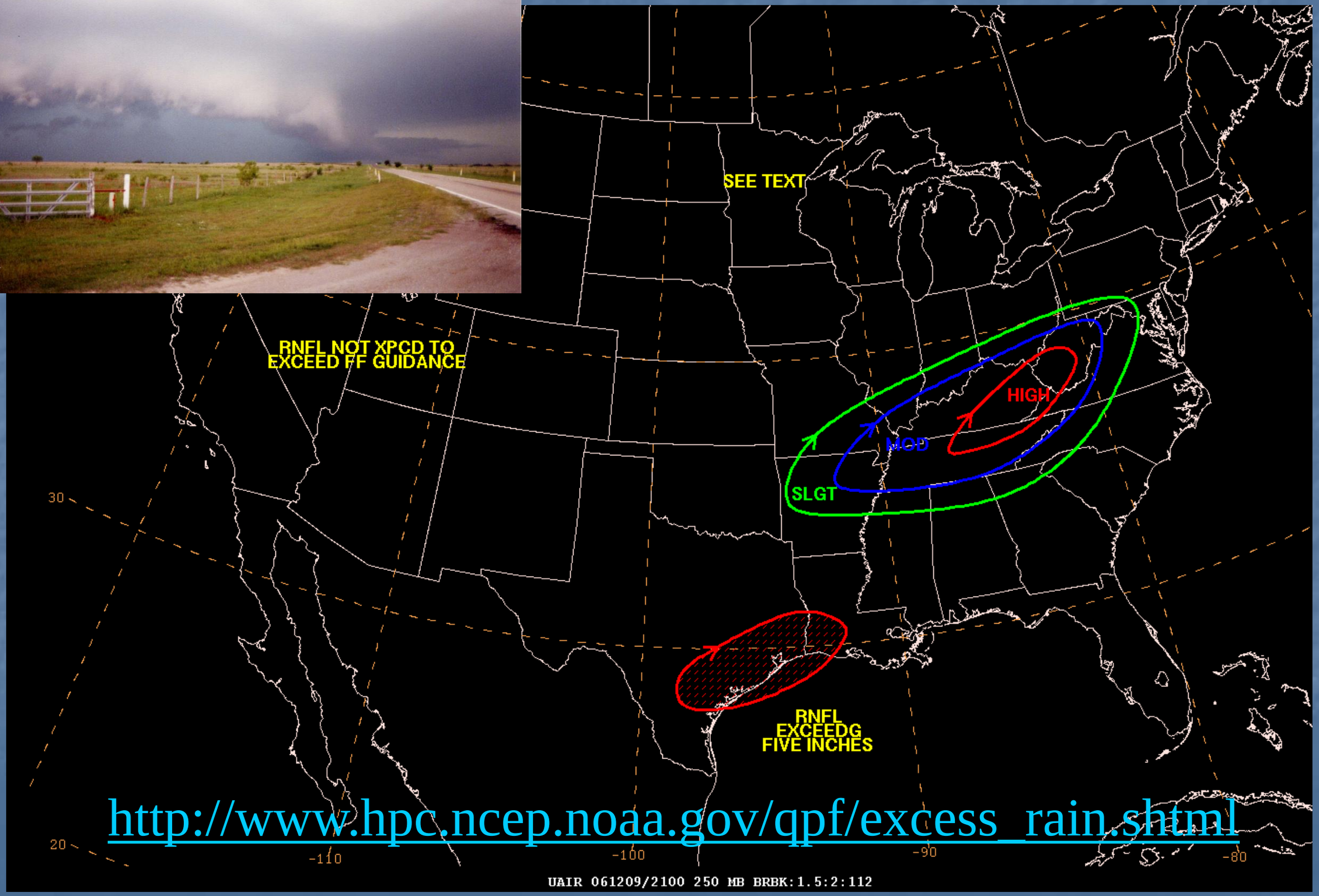


http://www.hpc.ncep.noaa.gov/nationalfloodoutlook/index.html

Excessive Rainfall

Part Flash Flood Guidance

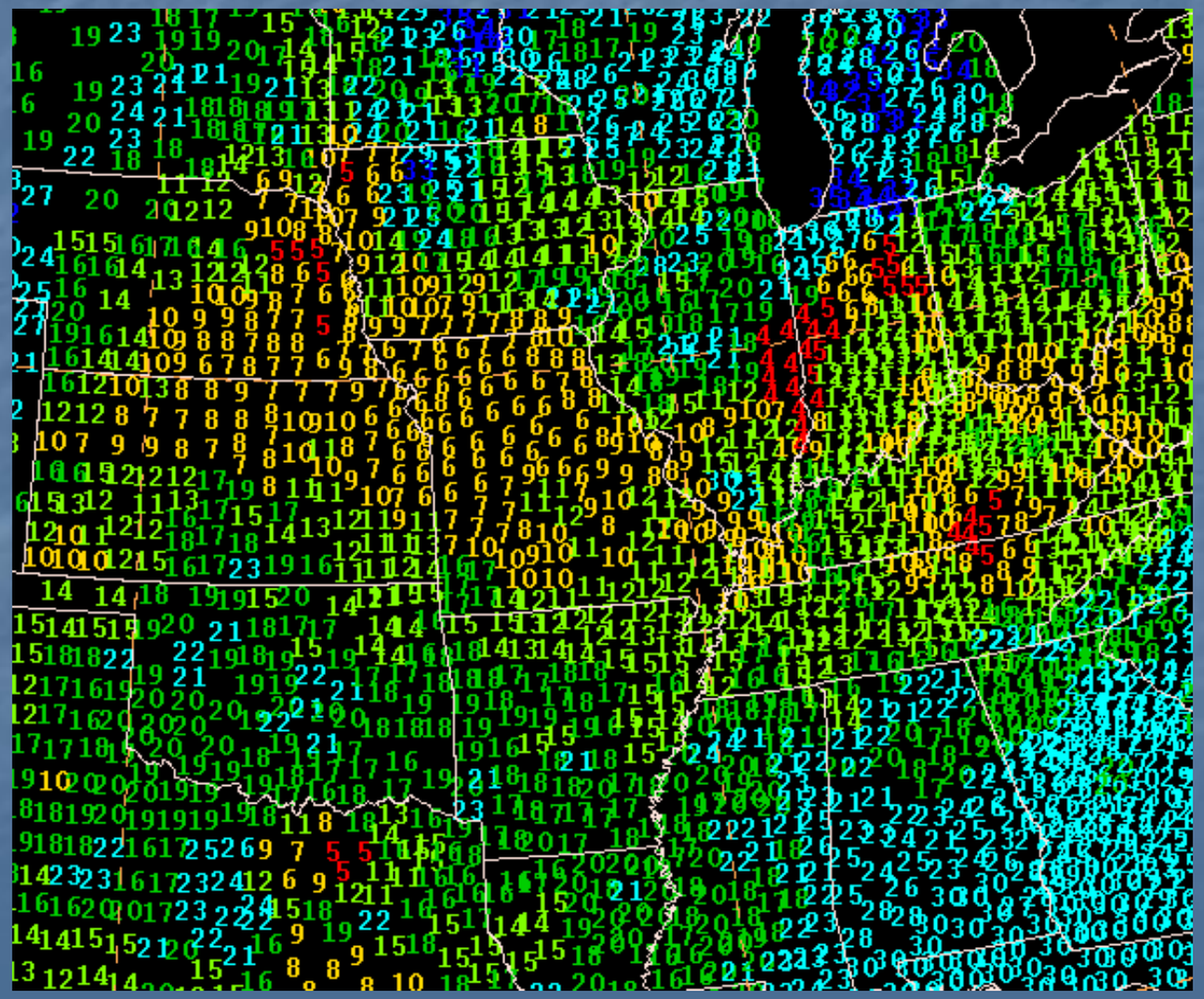
Part Rainfall



http://www.hpc.ncep.noaa.gov/qpf/excess_rain.shtml

What is Flash Flood Guidance?

- County “average” rainfall needed to cause flash flooding
- Always in flux (up or down), especially during heavy rainfall events
- One hour FFG generally used for convective rainfall
- Three hour FFG generally used for convective/stratiform rainfall
- Can be misleading at times
- FFG in steep terrain & urban areas is not very useful
- High FFG does not necessarily mean a low excessive rainfall threat and associated Flash Flood Threat



Little or no threat

- Rainfall not expected to exceed FFG
  - No excessive rainfall is expected during the forecast time period
- SEE TEXT
  - < 5% chance of rainfall exceeding FFG
- Slight Risk of rainfall exceeding FFG
  - 5% - 10% chance of rainfall exceeding FFG

Delineated by a **green** arrow/line encompassing an area

Moderate & High Risk

- Moderate Risk of rainfall exceeding FFG
  - 10% - 15% chance of rainfall exceeding FFG
  - **blue** arrow/line encompassing an area
- High Risk of rainfall exceeding FFG
  - >15% chance of rainfall exceeding FFG
  - **red** arrow/line encompassing an area

Total Rainfall > 5 inches

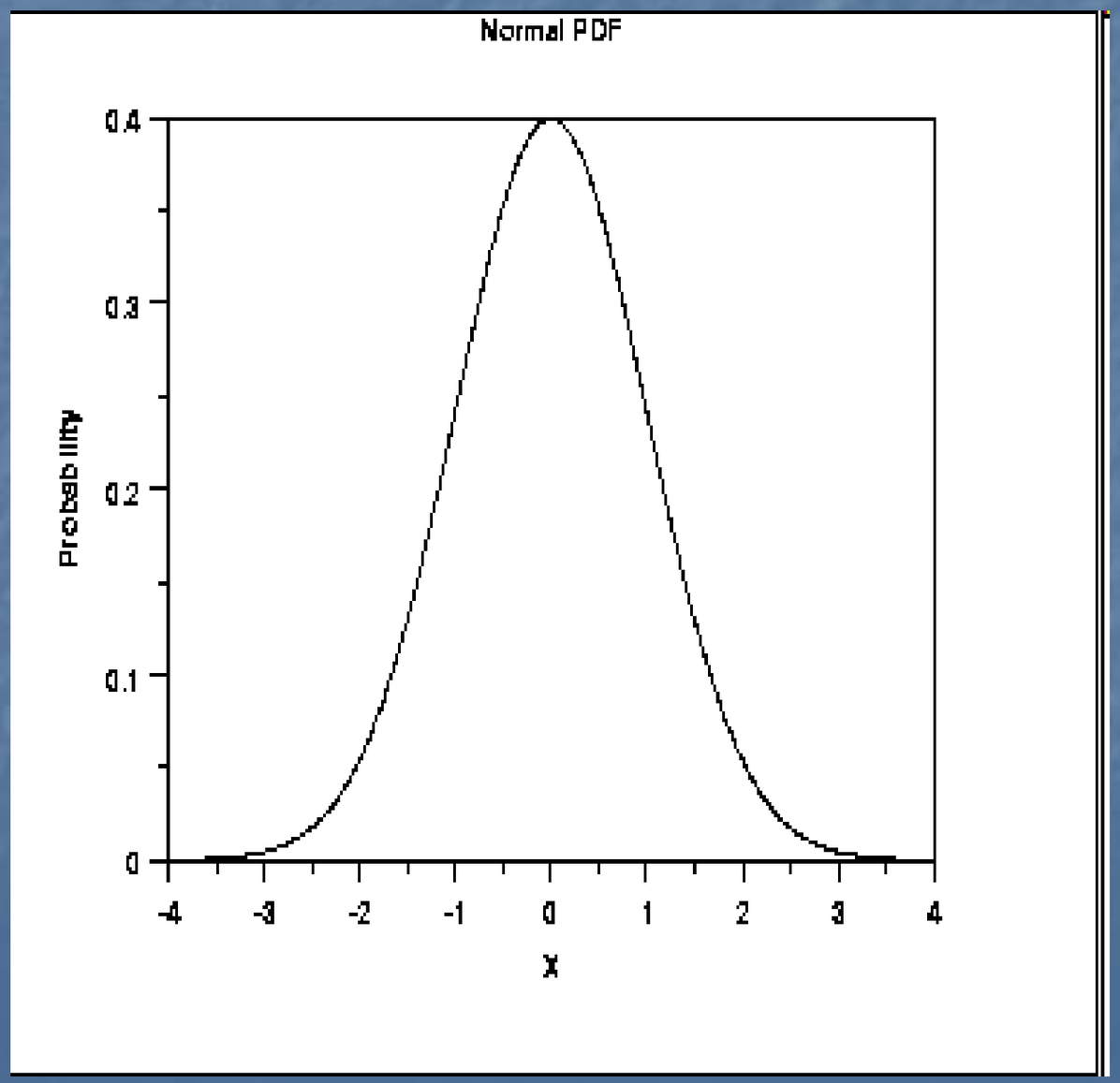
- Threat of 5 or more inches of rain during the forecast period
- Used mostly for:
  - Well organized MCS
  - Tropical systems
  - Persistent overrunning events

5 Inch

Probabilistic Quantitative Precipitation Forecasts

- How will this be done?
- How will these forecasts be used?
- When will products be produced?
- Where can users get this data?

Use a Probability Density Function (PDF)



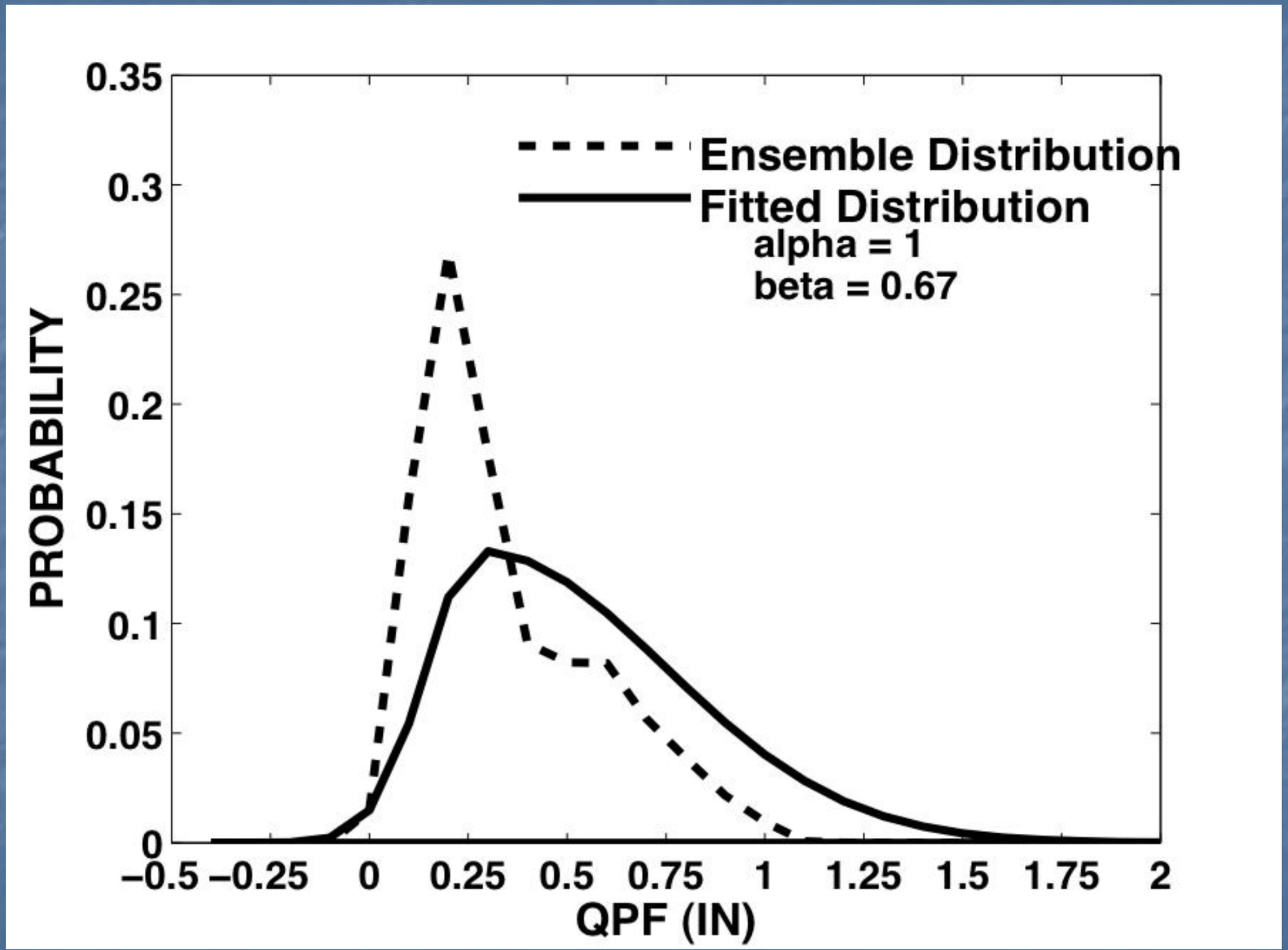
Advantages:

- Allows computation of probabilities of QPF exceeding arbitrary thresholds
- Allows determination of arbitrary confidence intervals
- Allows computation of inverse cumulative probabilities (e.g., percentile values)

Three Potential Solutions

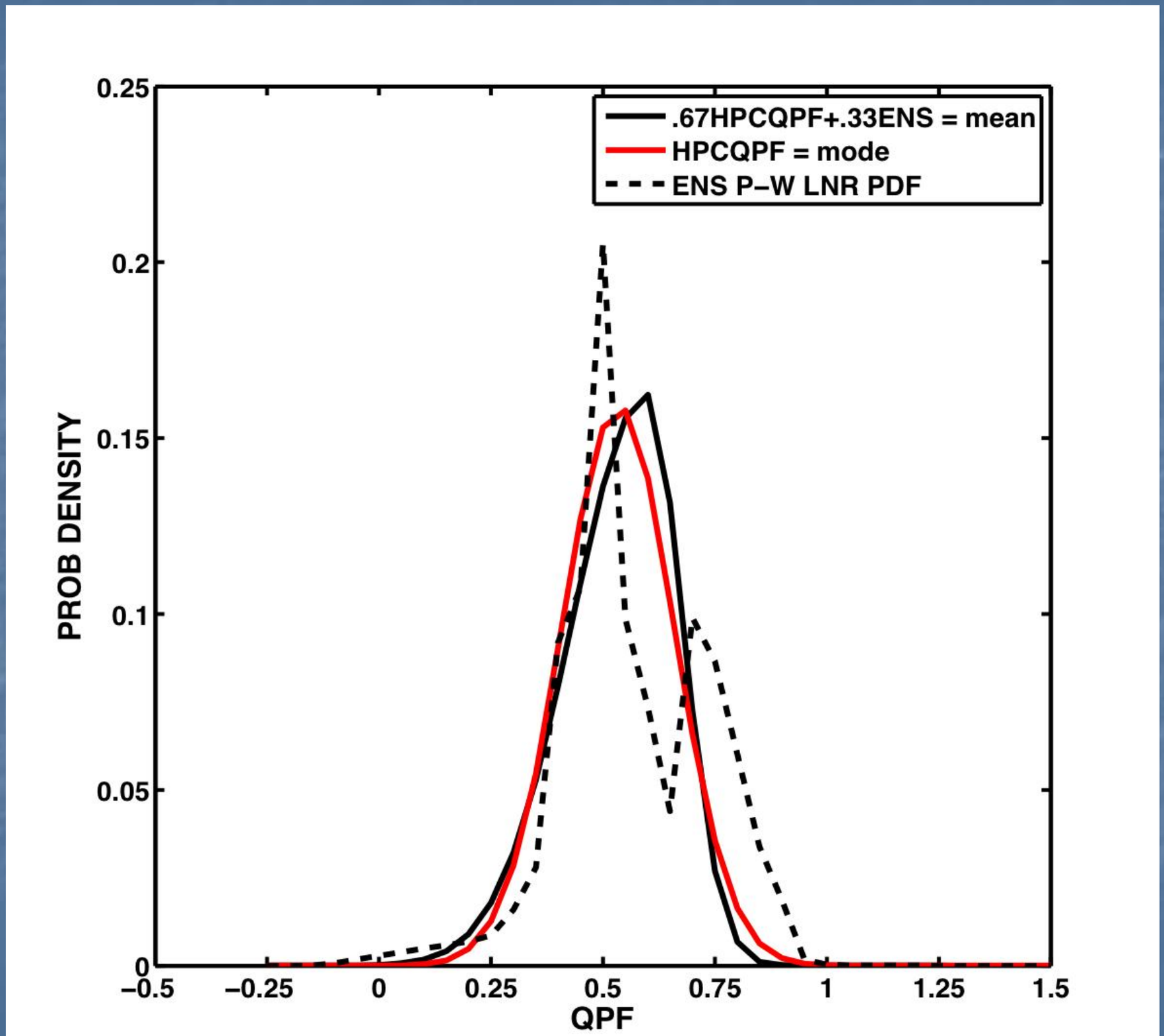
- Using a mix of HPC and Ensemble QPF forecasts.
- Three will be undergoing verification in order to see which method is best
  - #1 - Mean of distribution is weighted average of .67 X HPC QPF and .33 X ensemble mean QPF (SREF + NAM + ECM + GFS + HPC QPF)
  - #2 – Mode of distribution is HPC deterministic QPF
  - #3 - Mean of distribution is weighted average of .50 X HPC QPF and .50 X ensemble mean QPF (SREF + NAM + ECM + GFS + HPC QPF)

Example PDF for Method 1



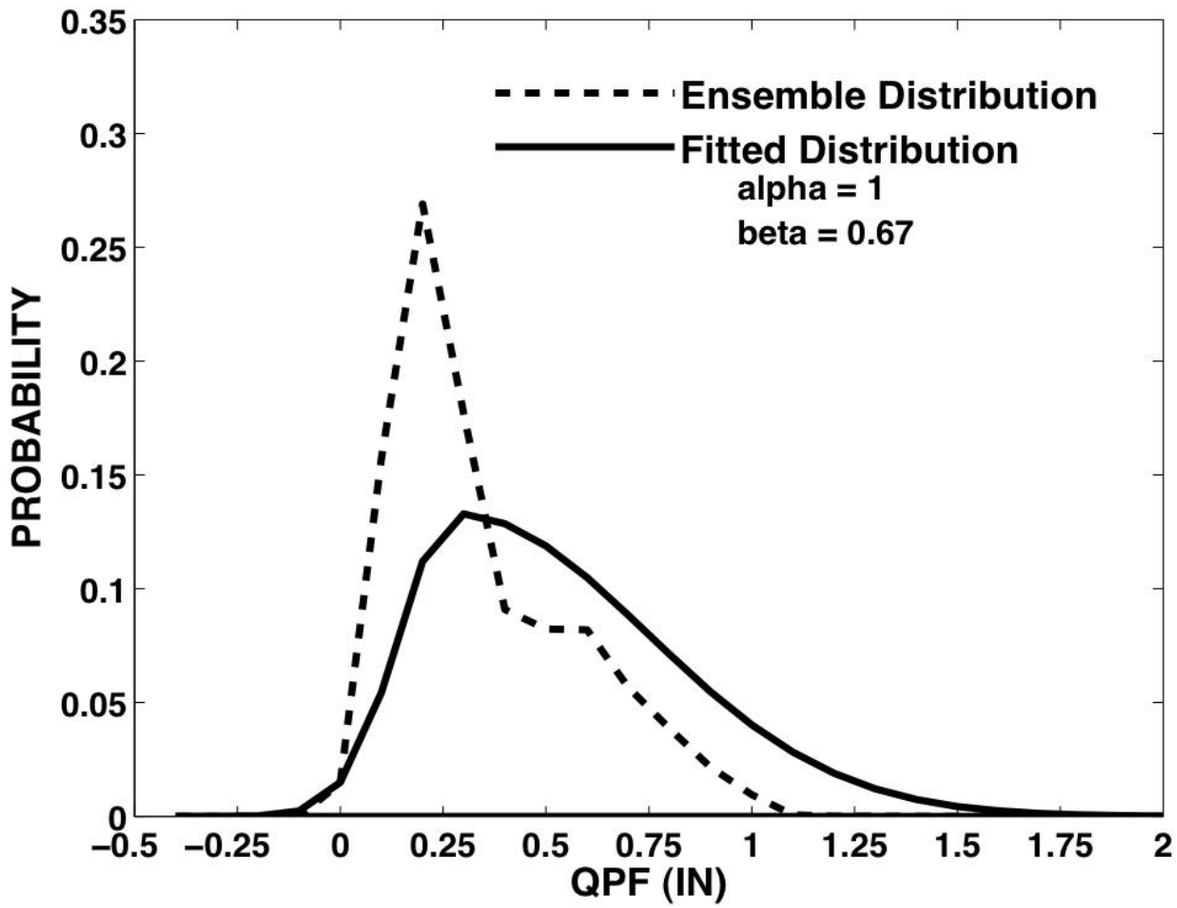
Here the fitted distribution shows the influence of explicitly using HPC QPF

Example PDF for Methods 1 (black) & 2 (red)

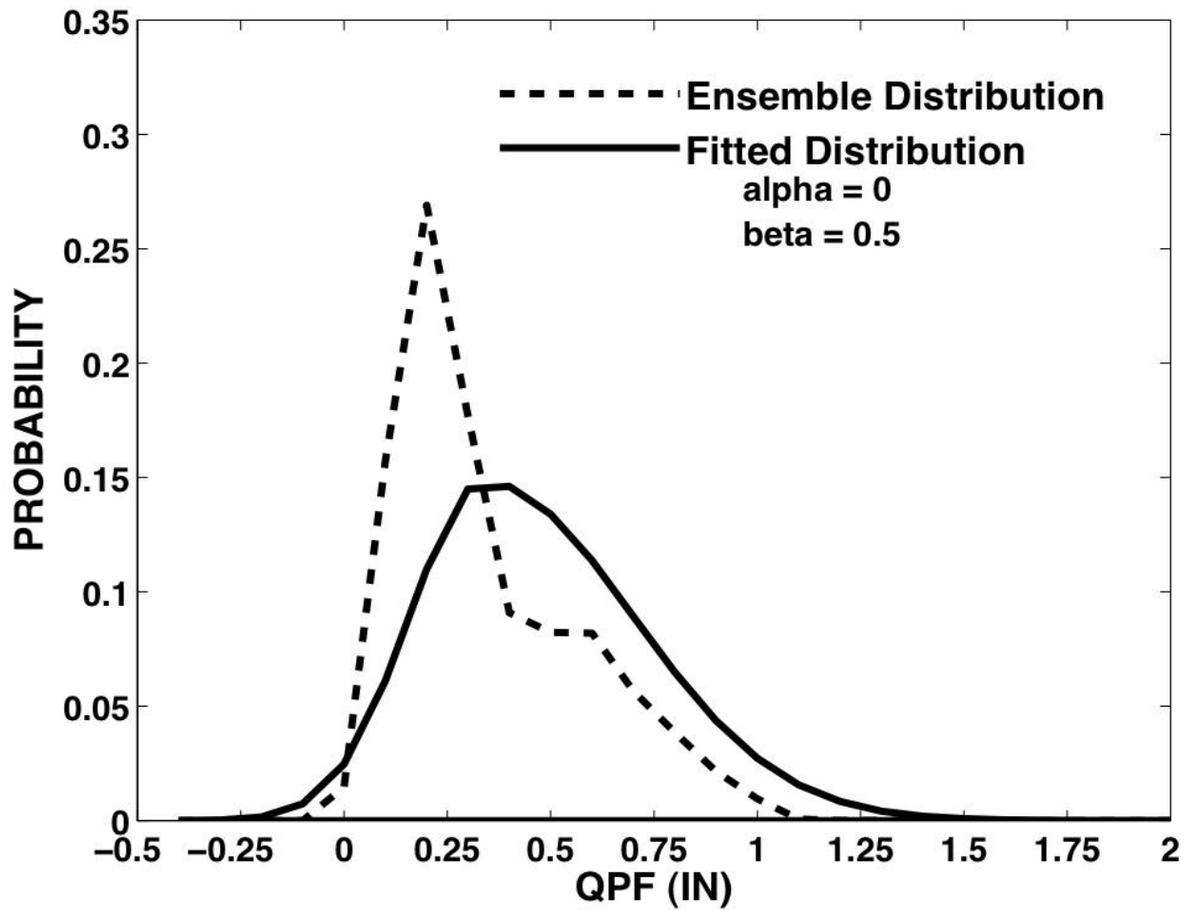


Example Comparison for Methods 1 and 3

METHOD 1



METHOD 3



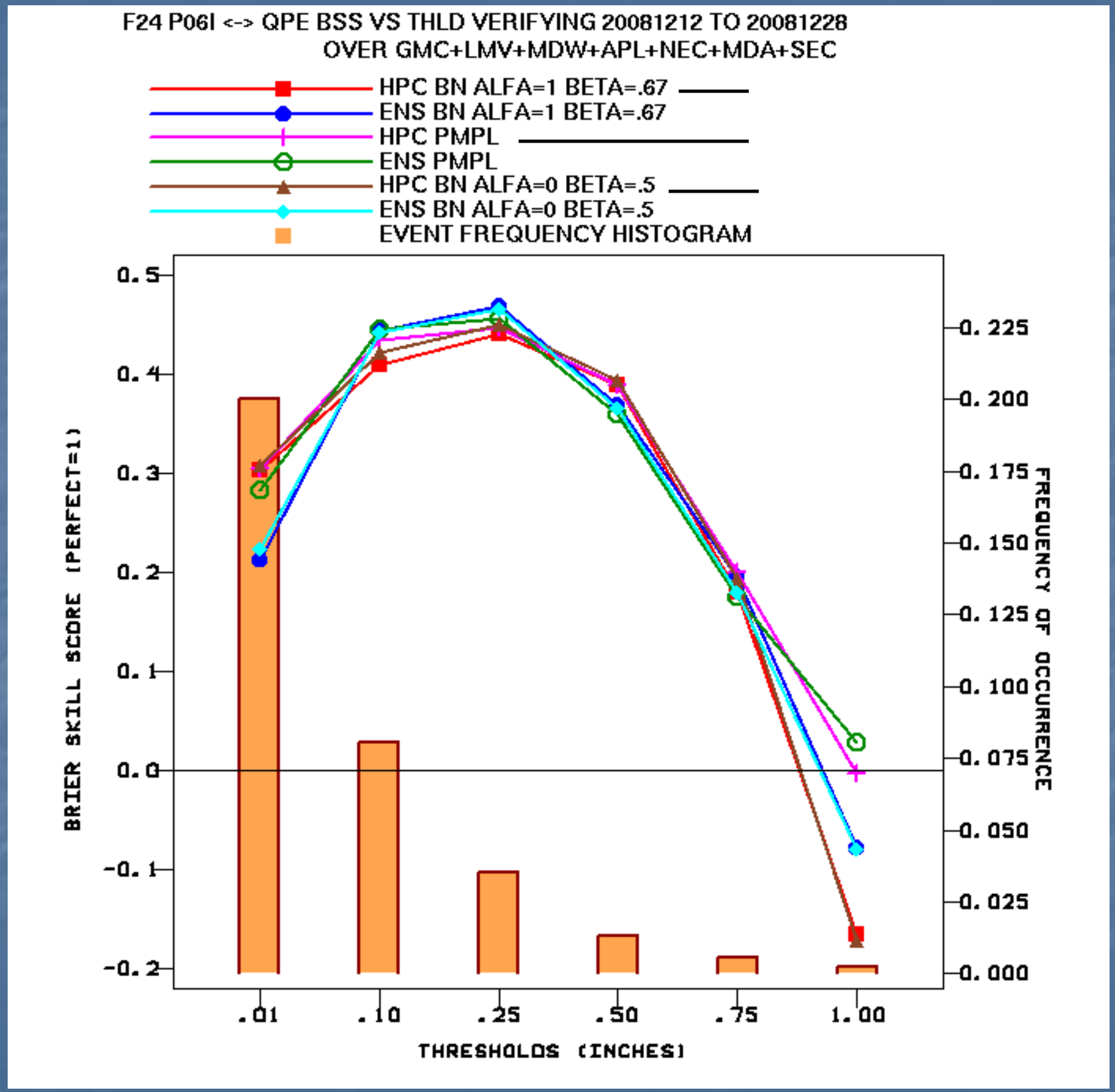
Method 3 slightly reduces probability of higher QPF values.

Verification Graphics

- Brier Skill Score (BSS) against *sample* climatology as a function of threshold up to 1 inch for all three methods and their respective benchmarks

- Attribute diagrams showing reliability and skill of each method compared to its benchmark

Verification of 24-h 6-h PQPF over Eastern CONUS

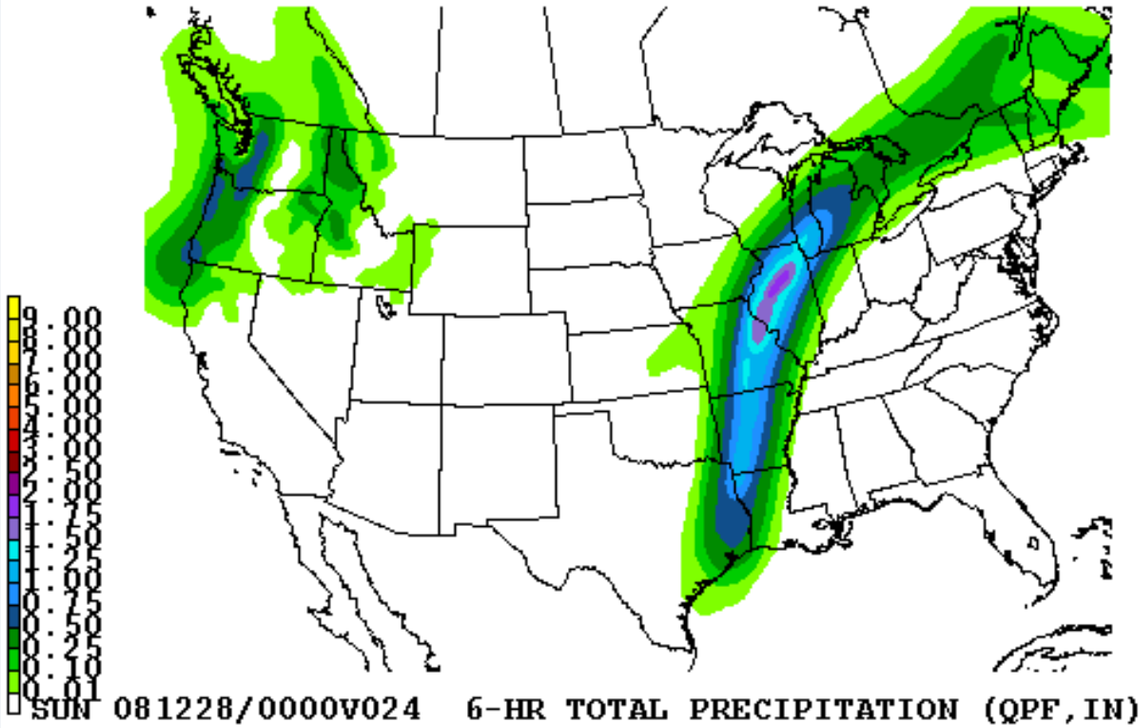


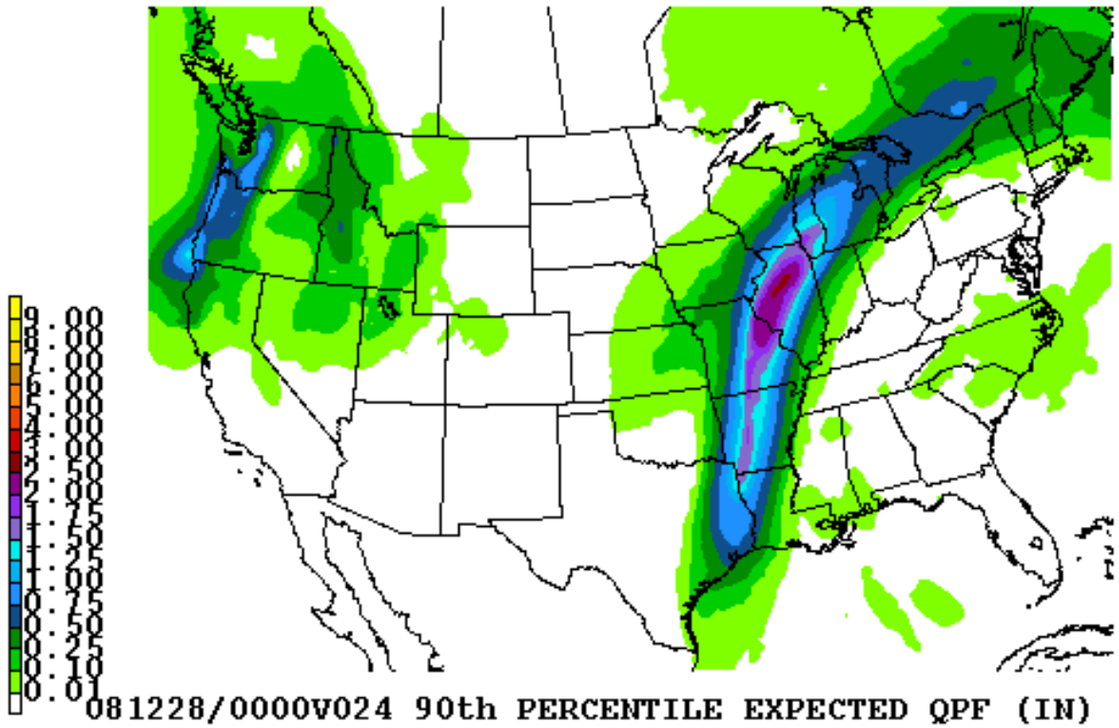
Verification so far…

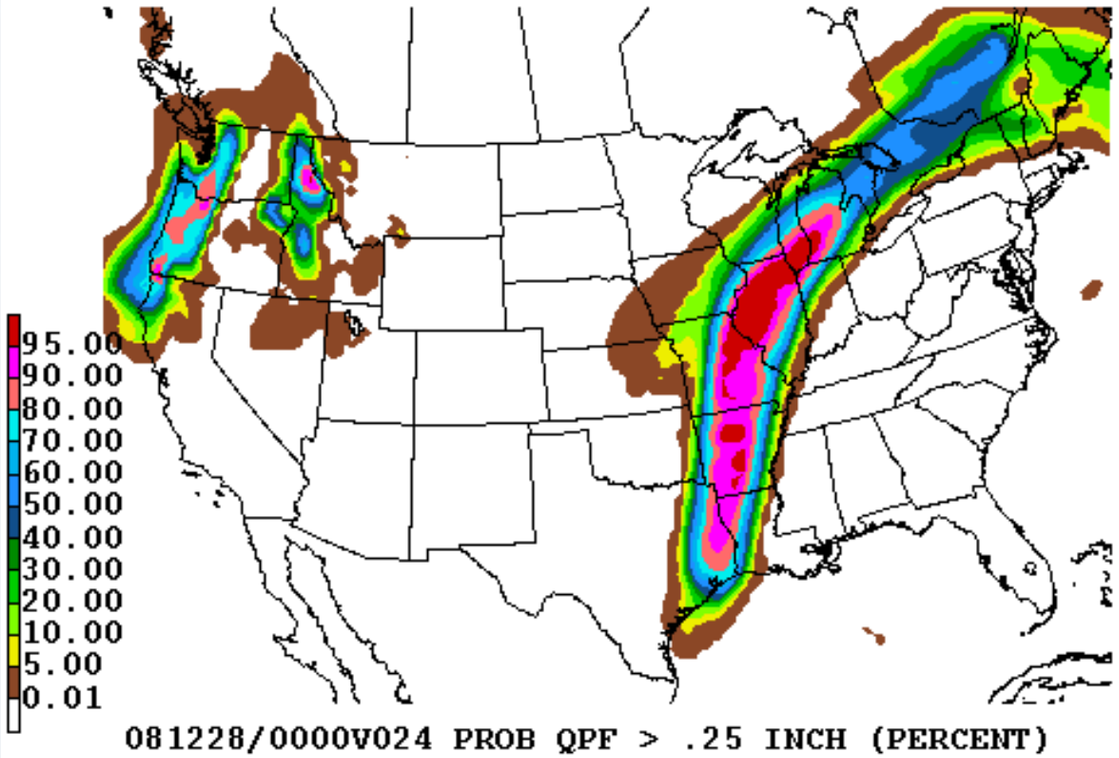
- HPC influence improves rain/no rain (.01 inch) probability forecasts over ensemble only forecasts

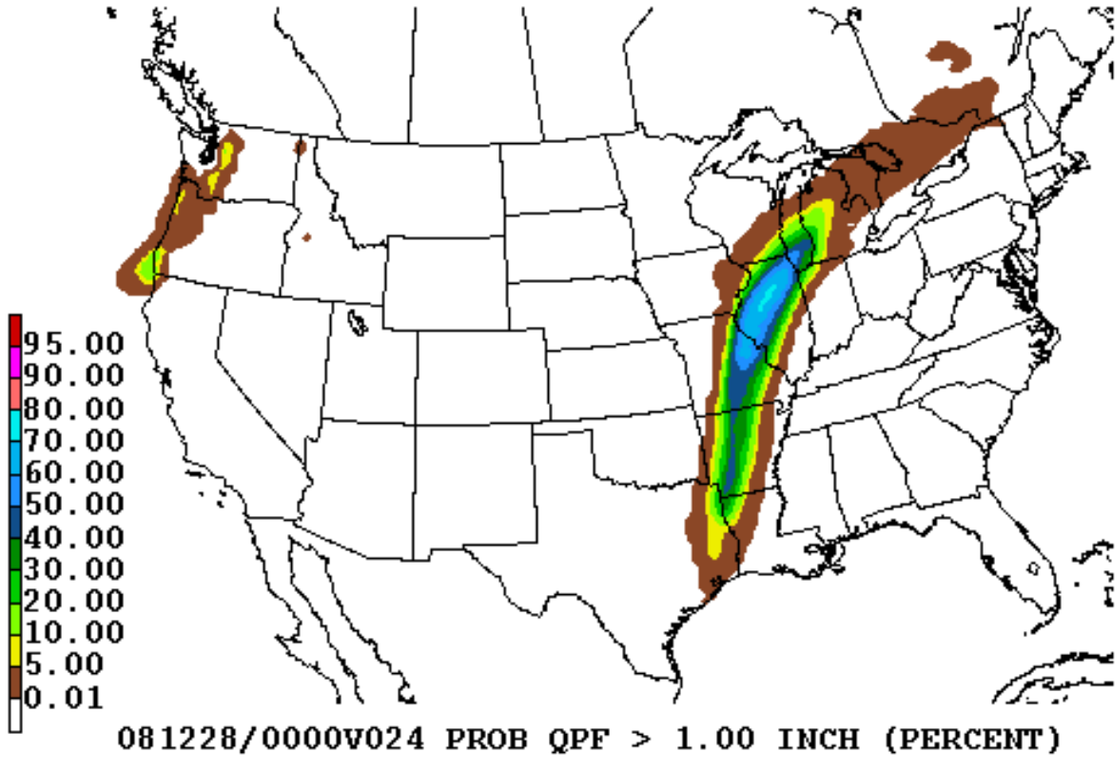
- Method 2 is slightly better at higher thresholds.

Example Products









Summary

- HPC will continue testing/evaluating Probabilistic QPF methods to arrive at a reliable forecast option/product

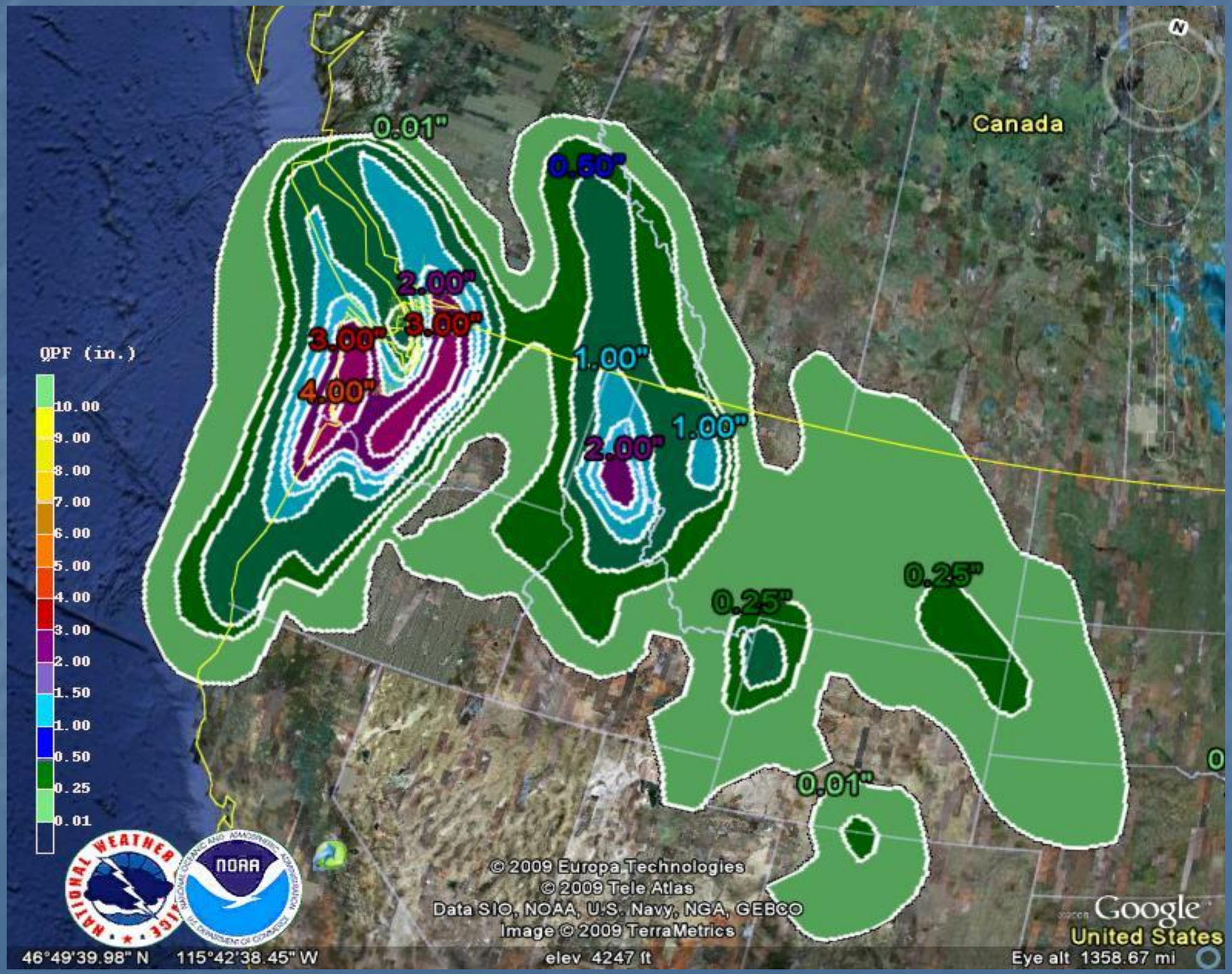
- Many uses for this type of information
  - Will enable users to better evaluate/gauge critical heavy rainfall situations
  - Will help them react effectively
    - Decrease loss of life and property & reduce cost

- Final product will be initially available HPC's web site (time frame is unknown) and then through other means of transmission
  - Using 'Google Earth' for enhanced display purposes
    - This will eventually apply to most of HPC products

- Users will be able to gauge HPC's uncertainty in Quantitative Precipitation Forecasts

Google Earth representation of HPC QPF

Future HPC products will be displayed in Google Earth



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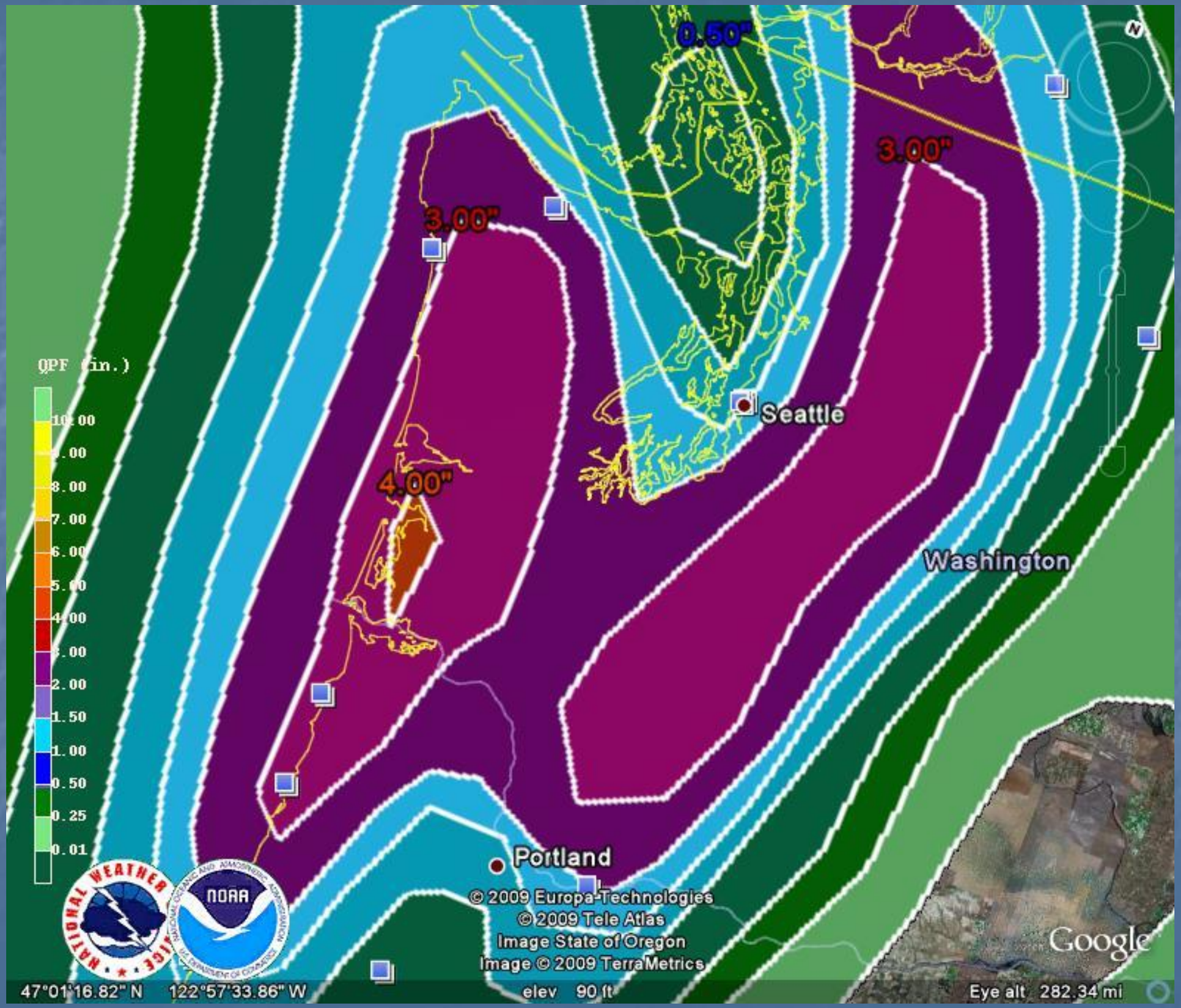

Questions ???

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